

REMARKS

Responsive to the Office Action of August 20, 2003, reconsideration of the above application is respectfully requested.

1. Claim rejections under 35 USC 112:

Claims 1, 12, 14, 16, 19, 27, 29, and 31 have been amended to overcome this rejection. Also, claims 15 and 30 have been cancelled.

2. Claim rejections under 35 USC 102:

Independent claims 1, 16, and 31 are rejected under 35 USC 102(b) as being anticipated by Uchida. Specifically, Uchida discloses a multi-layer mirror of compound semiconductor materials for a VCSEL.

The InP layers (103, 105 of FIG. 2) in Uchida's structure are not heat spreading layers. The ultimate destination for the heat generated in the active layer, in Uchida, are the metal contacts 110 that reside on top of the DBR layer 106 of the VCSEL. As these contacts are not adjacent the InP cladding layers, heat transverses the DBR layers to the top metal contacts thereby creating a poor thermal path.

In contrast, in the present invention, the InP layer provides a direct and high thermal conductivity path from the active layer to the adjacent lateral metal contacts (FIG. 1). Accordingly, claims 1, 16, and 31 have been amended to overcome this rejection.

Independent claims 1, 16, and 31 are rejected under 35 USC 102(b) as being anticipated by Jayaraman. Specifically, Jayaraman discloses a patterned wafer fusion process for manufacturing a VCSEL.

Again, the InP layers (64, 68 in FIG. 6) in Jayaraman's structure are not heat spreading layers. The ultimate destination for the heat generated in the active layer, in Jayaraman, are the metal contacts 78 that reside on top of the DBR layer 72 of the VCSEL. As these contacts are

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not adjacent the InP cladding layers, heat transverses the DBR layers to the top metal contacts thereby creating a poor thermal path.

In contrast, in the present invention, the InP layer provides a direct and high thermal conductivity path from the active layer to the adjacent lateral metal contacts (FIG. 1). Accordingly, claims 1, 16, and 31 are amended to overcome this rejection.

Independent claims 1, 16, and 31 are rejected under 35 USC 102(b) as being anticipated by Ramdani *et al.*

The Examiner contends that the Ramdani VCSEL discloses a thermally conductive heat spreading layer.

Respectfully, the Applicants' disagree with the Examiner.

Ramdani discloses a long wavelength VCSEL including mirror stacks and first and second cladding layers 24 and 25. While, Ramdani does show that these cladding layers may be made of InP, nowhere does he suggests, teach, or disclose the use of InP cladding layers for spreading heat away from the active region. In fact, the InP layers in Ramdani serve only as contact layers for allowing current to be injected via adjacent metal contacts.

Specifically, Ramdani discloses that these InP layers are required to be heavily doped (col. 4, lines 26-35) for allowing current injection from lateral metal contacts (col. 4, lines 35-39). Thus, since these layers are heavily doped, they will be substantially thin to minimize the optical loss of the structure which means that such thin InP layers cannot simultaneously act as heat spreading layers.

Furthermore, Ramdani discloses placing the electrical contacts on the lower surface of the substrate (col. 3, lines 32-35) if the mirrors are doped, in which case there would be no need for the InP cladding (i.e., contact) layers 24 and 40. Thus, in Ramdani, the InP layers merely act as contact layers (and NOT heat spreading layers) for permitting current injection into the active region, in case the mirrors are NOT doped (col. 4, lines 26-39).

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In contrast, the present invention includes cladding layers that function as heat spreading layers. The Applicants' have discovered that by placing InP layers, with thermal conductivity higher than that of the mirrors (para 24, and FIG. 2), adjacent the active region, allows heat to bypass the mirrors. Thus, this heat extraction mechanism permits an efficient operation of the long-wavelength VCSEL.

Accordingly, claims 1, 16, and 31 have been amended to overcome this rejection.

New claims 33 and 34, modeled after claims 16 and 31, are added to further distinguish the present invention.

In view of the above, it is submitted that this application is now in good order for allowance, and such early action is respectfully solicited. Should matters remain which the Examiner believes could be resolved in a telephone interview, the Examiner is requested to telephone the Applicant's undersigned attorney.

Respectfully submitted,



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